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ABSTRACT

This pamphlet produced by the International Telecommunication Union (ITU) outlines the development and progress of a project designed to develop a model for vocational training in telecommunications. The Course Development in Telecommunications (CODEVTEL) approach is discussed in terms of job-related training, teaching materials, sharing resources, and the application of the training and development guidelines. Advantages of the CODEVTEL approach are reviewed and include comments on pooling resources, improved quality and standardization of vocational training, cost/benefit ratios, and operational organization. It was reported in the conclusions concerning phase 1 of the project that producing and sharing materials is feasible. Proposals for the second phase are included and identify the utilization of existing courses, adaptation procedures, and the development of new courses as the main thrust. Future prospectives are reviewed in the context of technical cooperation among developing countries and the use of technology adapted to the precise needs of user countries. An 11-item glossary and an array of charts and pictures depicting the project's activities are included. A guide describing the 14 phases of training and development are appended. (BPB)

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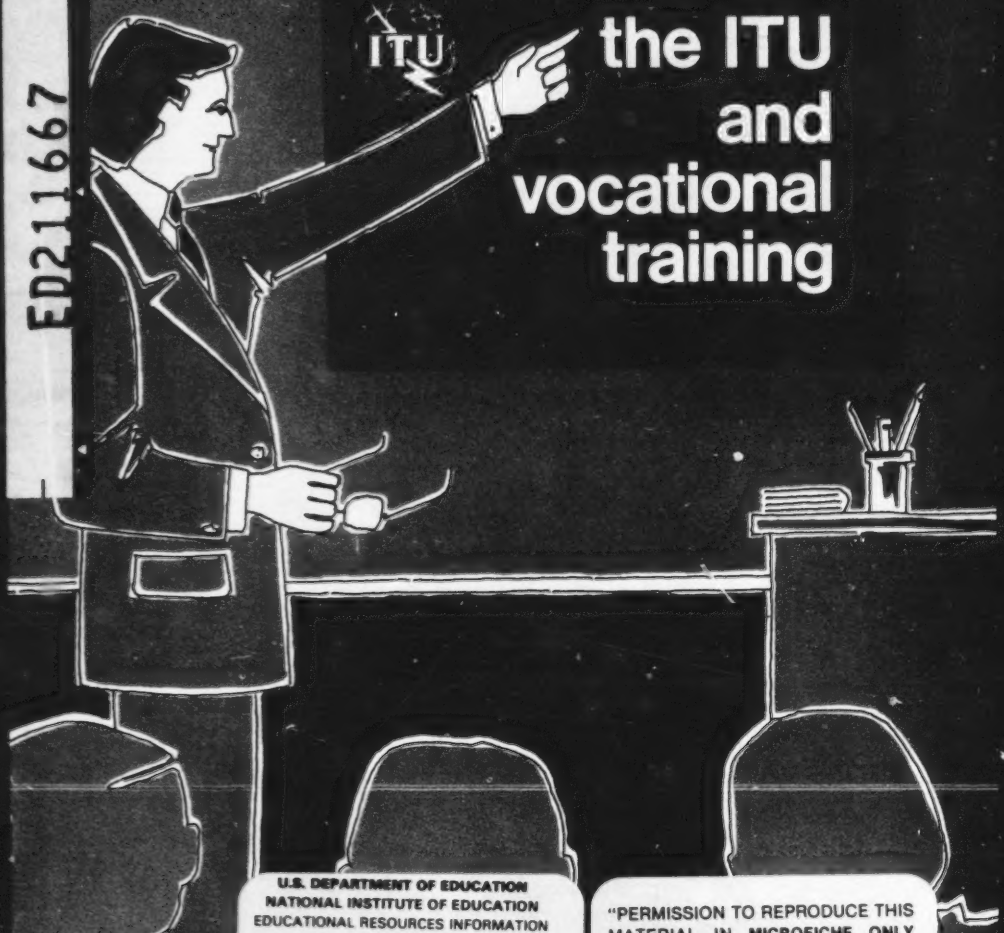
the ITU and vocational training



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INTERREGIONAL PROJECT FOR COURSE DEVELOPMENT IN TELECOMMUNICATIONS

2

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I. INTRODUCTION

Since March 1975, the ITU has been engaged in a project for the development of vocational training in telecommunications, during which seven training centres set up with ITU assistance, following the most modern teaching principles and using a standardized approach, have produced seven training courses of very high quality, for example, on radio relay maintenance, planning of rural telecommunication networks and so forth.

The project has been named CODEVTEL (Course Development in Telecommunications) and has produced "Training Development Guidelines" which have served as a basis for national course development teams in Singapore, Nairobi, Oran, Yaoundé, Rufisque, Caracas and San Salvador. Each team was composed of national course developers* trained during the project, with the participation of subject matter experts* (sometimes ITU experts). Each team was advised and assisted by an ITU expert in course development working part-time for the team. Experts were made available to the project for various periods by France, Netherlands, Sweden and Switzerland and by manufacturers of telecommunication equipment (CGCT, LM Ericsson, Thomson CSF, NEC, ORMAT).

The purpose of this pamphlet is to explain the working methods followed and the results obtained and to propose a new phase during which these methods would be generally applied and an increasing number of countries would benefit by the results obtained.

In taking this initiative, the ITU is complying with Resolution No. 23 of the Malaga-Torremolinos Plenipotentiary Conference, which instructed the Secretary-General, inter alia, "to make recommendations to the developing countries for the solution of their training problems, drawing upon the experience acquired in this field by the Members, particularly with regard to installations, equipment, study programmes and teaching methods and facilities. To this end, it requests him to draw up, in consultation with the Members of the Union, standard texts for technical and operational training in telecommunications".

* See glossary on pages 11 to 13

II. THE CODEVTEL APPROACH

The model used for the development of vocational training in telecommunications (the CODEVTEL approach) was initially designed by a sub-group of the Working Group on Training Standards. The fact that 20 developing countries (some of the 7 training centres concerned being multinational) have applied this model has enabled the method to be adapted to the particular circumstances of developing countries and has made it possible to introduce sufficient flexibility to adjust training methods to the special needs of individual countries. The model is designed to deal with a number of specific problems, such as :

- the shortage of adequate staff
- lack of coordination between training institutes and operational services
- the frequent use of antiquated training programmes and methods
- absence of standards for job performance.

In dealing with these problems, four basic principles are applied :

1. Job-oriented training

Vocational training is designed to meet the specific requirements of telecommunication jobs and trainees are therefore made "operative" as quickly as possible. This job orientation implies that jobs must be accurately described in advance, and the descriptions sometimes require a considerable amount of work, depending on the type and level of the job.

2. High-quality teaching materials

The teaching materials* are of good quality and are accompanied by instructor guides giving sufficiently clear instructions to allow the teaching materials to be used effectively even by relatively inexperienced instructors*. The instructors must be technically competent and must be given basic training in using the teaching material.

* See glossary on pages 11 to 13

The quality of the materials is ensured by rational choices based on a very elaborate preliminary analysis and by systematic tests of all new materials on future student population samples.

The training methods used vary widely and include :

- individual tape-slide presentations, comprising a series of slides accompanied by a commentary recorded on a cassette;
- work books which may contain exercises, practical examples and forms;
- printed documents for individual study;
- case studies comprising detailed descriptions of hypothetical problems, (but as realistic as possible) that the trainee have to solve. The solutions proposed are then examined jointly;
- practical work on models or on real equipment, simulating as closely as possible the tasks that the trainee will have to carry out in practice;
- programmed texts in which new material is presented in small, easily assimilable sections; the trainee is invited by numerous questions to check his knowledge as he proceeds. He then checks his answers by comparing them with those appearing in the margin of the text, which he uncovers as he goes on;
- frequent tests, many of them multiple-choice or practical.

3. Pooling of productive resources

In the CODEVTEL project, the courses produced in each country are made available to all the other countries participating in the project. During the first phase, therefore, each of the seven training centres produced a high-quality course and, after translation, each centre will be supplied with the seven courses. The same teaching materials can be used at all training centres where students are trained to perform the same tasks.

Adjustments will be necessary to take account of differences, for example, in telecommunication equipment, the social and cultural level and background of the trainees and their learning habits. This adjustment of course represents only a fraction of the work required to prepare a new course.

Attempts had already been made to use in training centres teaching materials produced elsewhere; but owing to the lack of common standards, success was always very limited.

4. Application of the "Training Development Guidelines"

Each new course is produced by a team consisting of at least a course developer, a subject-matter expert and the supporting administrative, artistic and technical staff. This team applies the development process described in detail in the "Training Development Guidelines" (TDG).

For each new course, the CODEVTEL approach described in the guidelines consists of fourteen phases, the overall purposes of which are :

a) the detailed analysis of training problems;

b) the development of a training course which can solve the problems analysed;

c) the production of teaching materials and the conduct of the training;

d) an evaluation* of the development process and of the results obtained.

These fourteen phases (Figure 1) are described in greater detail in the annex to this pamphlet.

* See glossary on pages 11 to 13

III. PROGRESS AND RESULTS OF THE PROJECT (PHASE I)

When the work was sufficiently advanced, three seminars were held, in Singapore, Rufisque and San Salvador, in order that the provisional results of the project could be communicated to a larger number of countries. During these three seminars, the development process was described in detail, the training needs of the participating countries were examined and a number of training modules and accompanying documents were presented. In all, 186 participants from 57 countries attended the seminars. They approved the idea of international collaboration in training development and expressed the need for assistance in organising such collaboration.

At the present time, most of the CODEVTEL teams are engaged in the validation* of the teaching materials produced (Phase II of Figure 1) with a view to translation and exchange among the various centres.

Inevitably, work has not progressed at the same rate in all the training development centres*. It may be expected, however, that all the materials produced will be translated into the Union's three working languages by May 1978 at the latest. These materials are described in Table 2.

IV. ADVANTAGES OF THE CODEVTEL APPROACH

The experience acquired in Phase I of the CODEVTEL project has demonstrated certain favourable results of the introduction of this new approach in an administration. The following advantages can be expected :

- the pooling of physical and human resources, leading to significant savings, particularly on any future vocational training project;

- improved quality of vocational training; this is evident, inter alia, from the very favourable reaction of the trainees to the new courses;

* See glossary on pages 11 to 13

- the gradual standardization of vocational training as recommended in Resolution No. 23 of the Malaga-Torremolinos Plenipotentiary Conference;

- an appreciable overall improvement in the cost/benefit ratio* of vocational training on the basis of the experience acquired in certain administrations and the initial practical results of the project; such improvement would mean a reduction in the length of training required and greater professional skill of the staff trained, leading to better quality of service.

A number of secondary advantages were also observed :

- the operational services participate actively in drawing up training objectives;

- the preliminary analysis and evaluation of courses may facilitate the gradual introduction of a management information system in the administration's management service;

- during the preliminary analysis, the study of operational problems not directly connected with training may sometimes lead to the proposal of solutions for the rationalization of organization, procedures and so forth.

V. COST-EFFECTIVENESS OF COURSE DEVELOPMENT

The provisional results obtained with the courses validated at Singapore and Rufisque show that trainees who have taken a course produced by the CODEVTEL project very quickly become competent in their jobs. Since the training period is less than that of traditional courses, a considerable amount of time can be saved.

The cost-effectiveness of the development of a new course depends on the number of students to be trained, since the investment in the systematic development of a course must be amortized. In the case of the radio relay course produced at Rufisque, a provisional calculation has shown that the initial investment of approximately US $ 180,000 (including ITU experts, bilateral experts, travel, equipment, training of course developers, supporting services, etc.) could be amortized by training about a hundred students.

* See glossary on pages 11 to 13

It may be concluded from this that the operation is profitable even under the difficult conditions inherent in the experimental nature of the project (inexperienced course developers, testing of new methods and techniques, unsuitable production equipment, etc.).

Nevertheless, the cost price of high-quality course development continues to be high. At the present time, many developing countries cannot by themselves either bear the cost of such course development or make it cost-effective, since the number of people to be trained in each country is often too low. The multinational training centre at Rufisque is an example of a cooperative effort in which several countries pool their resources to make high-quality course development economically viable.

With regard to the profitability of adapting the teaching materials thus produced, if it is estimated, for example, that the cost of such adjustment in another country would be about US $ 10,000 for the radio relay course mentioned above, then, all things being equal, a total of five trainees might warrant the expense.

VI. CONCLUSIONS CONCERNING PHASE I OF THE PROJECT

The CODEVTEL project has made it possible to test the approach described and to produce the necessary documents and control procedures. Moreover, this first phase has proved the feasibility of producing teaching materials based on common standards in several centres and of exchanging these materials. The results obtained led the UNDP/ITU evaluation mission which met in Geneva in October 1977 to recommend that a second phase should be planned.

The purposes of the second phase would be to involve a larger number of countries in coordinated course development and to establish a number of centres for the production of teaching materials. In this way a growing number of countries will be able to take advantage of the results of the first stage and can be expected to apply training standards with a view to the standardization of tasks in telecommunications and the harmonization of network operation. Increasingly close international cooperation could thus be established, to the special benefit of the developing countries.

VII. PROPOSALS FOR A SECOND PHASE

The second phase of the project referred to here will be described in greater detail in the project document. The main points are as follows :

1. Utilization of existing courses

The courses produced during the first phase of the project (instructor guides, handouts, job aids, tests, slides, cassettes, transparencies, descriptions of laboratory equipment) will be made available to administration Members of the ITU which intend to take part in the second phase. Table 2 outlines these materials.

To be used effectively, these materials need to be adapted to the specific needs of each administration : adjustments may be needed according to the level of trainees, the type of telecommunications equipment, established procedures and so on. The ITU will assist and advise the administrations in carrying out this adaptation according to the procedure described below.

2. Adaptation procedure

In the first place, the task analyses, training objectives and all teaching materials must be examined in detail by a specialist in the jobs concerned. This specialist must be familiar with the conditions in which the materials are to be used. He should indicate the changes required by these new conditions. Any changes that may be necessary will then be made by a course developer.

For the training of these course developers, the administration may participate in one of the training workshops for course developers which are to be organized as part of the second phase of the project.

Laboratory equipment (models, etc.) must be prepared in accordance with the specifications supplied in the course materials provided by the ITU.

The instructors who will provide the training must first be trained themselves in the use of the materials. At the very least, they must assimilate the content of the course and must themselves pass all the tests, perform the exercises and so forth. The ITU may assist in the training of these instructors according to the needs expressed by the various administrations and within the limits of the available resources.

To validate the course in the new administration, a sample of future groups of trainees must undergo the training. The results of this pilot training should be examined in detail and may give rise to corrections of the materials, presentation, etc. Finally, an adjustment report must be produced.

The cost of this adaptation varies with the duration of the course and the extent of the changes to be made. Adaptation work for a course of 1 month may represent between 1 and 10 man/months. If expensive equipment has to be used, its cost price must be added to these figures.

3. Development of new courses

During the second phase of the project, new courses are to be developed following the approach described here. The training development centres will be determined in response to the requests presented by the administrations who wish to participate in this second phase.

The proper operation of a training development centre calls for the following facilities :

- premises, which must comprise an office for the coordinator, at least one office for the course development team and enough space for the production, testing and storage of teaching materials;

- administrative facilities for conducting a large volume of correspondence and producing and reproducing high-quality printed documents;

- technical facilities for producing drawings, photographs, sound recordings, transparencies and models for practical work;

- if individualized courses are planned, provision should be made for a minimum of two individual study carrels, each equipped with a tape-slide projector;

- for each new course to be developed, at least one subject-matter expert should be engaged for a man/month duration approximately eight times greater than that of the course;

- course development expert, to be provided by ITU as a part of the second phase of the project;

- possibility of testing the materials in normal training conditions : provision should be made for the validation of the courses prepared in the training development centres, either in group training conditions with a pilot class or individually with a number of trainees chosen as a representative sample of the groups concerned;

- international coordination : the activities of the various training development centres will be coordinated with those of other development centres by the project coordinating unit stationed at ITU headquarters in Geneva.

VIII. FUTURE PROSPECTIVES

Already now the CODEVTEL project brings forth initiatives tending to establish international cooperation for course development in telecommunications. During the second phase of the project, ITU at the request of interested countries, proposes to facilitate the establishment of multinational coordination units intended to ensure course development according to the needs of these countries. The new courses will be prepared in well-equipped national or multinational training centres and will be distributed among participating countries.

Through these coordination units two basic principles can be gradually implemented, the importance of which is more and more recognized for technical cooperation, particularly by the UNDP Governing Council.

The first principle is technical cooperation among developing countries (TCDC). The national course development teams trained under the CODEVTEL project will be able to ensure course development for all countries participating in a particular coordination unit and the usage of common resources available (human resources, means of production) will be a direct application of this principle.

The second principle is the use of technology adapted to the precise needs of user countries. In this case, the mentioned coordination units could, subsequently, be subject to a cooperation agreement between the host country, the participating countries, UNDP and ITU. These units will be responsible for the course development procedures applied for the priority given to various courses and for the selection of objectives. Autonomy in the field of course development is expected to be achieved gradually.

Considering the regional differences, a great flexibility in the execution of the second phase has to be foreseen. Some countries could choose to establish a course development centre, other countries may only choose an adaptation of courses produced elsewhere; and others could decide to establish a multinational cooperation unit as mentioned above. Figure 3 shows examples of some possible structures. In every specific case the structure should be adopted according to the particular needs of the region and should allow an efficient coordination of course development activities.

GLOSSARY OF SPECIALIZED TERMS

Development centre

Place where courses are developed for an organization or group of organizations.

Course developer

Person responsible for course development and trained for this purpose.

Course development

A series of activities designed for :

1) determining the objectives, content and presentation of a course on the basis of an analysis of the training needs of a group of persons (trainees) intended for a specific job;

2) defining, producing and validating teaching materials for the course;

3) evaluating the results of the course.

The term "course" should be understood in its broad sense, i.e. as covering all vocational training activities. The more accurate term "vocational training development" is avoided in this pamphlet because of its length.

Evaluation

In the context of vocational training, the term used to designate all activities undertaken for the collection and analysis of data on the results of vocational training at different levels (trainees' reactions, measurable acquisition of knowledge, operational results, etc.) and for drawing conclusions from these data. The conclusions should lead to the improvement of vocational training, its adjustment to new requirements of the organization and so forth.

Instructor

Person responsible for imparting vocational training, in the broad sense : discussion leader, monitor, teacher, etc.

Vocational training

All the activities undertaken to help the personnel of an organization to acquire the knowledge, skills and attitudes required for the proper performance of their duties.

Teaching material

All the materials used specifically for a given course : instructor guides, audiovisual aids (transparencies, slides, films), trainee handouts, tests, etc.

Training module

Training unit during which the trainee attains a specific training objective. A module should be followed by a test to check that the trainee has attained the objective; the module is generally preceded by a test to ascertain whether the trainee needs the module and whether he has the necessary knowledge and skills to follow it.

Cost/benefit ratio

Ratio expressing the profitability of a training activity. The benefit of a course is equivalent to the profit that the organization derives from it : more efficient personnel, better operational results, etc. The benefit is calculated in relation to an alternative situation, for example, the situation prevailing before the introduction of the new course. The cost of a course is the total expenditure on the development and conduct of the course : salaries and other staff expenses, equipment costs, production of teaching materials, use of premises, etc.

Subject-matter expert

A person capable of describing in detail the various duties of a given job and the knowledge and skills required to perform them. The term "job expert" is also used.

Validation

All activities undertaken to determine experimentally whether the teaching materials designed for a course are such that the trainees attain the objectives fixed for the course, and to effect the necessary improvements.

ILLUSTRATIONS

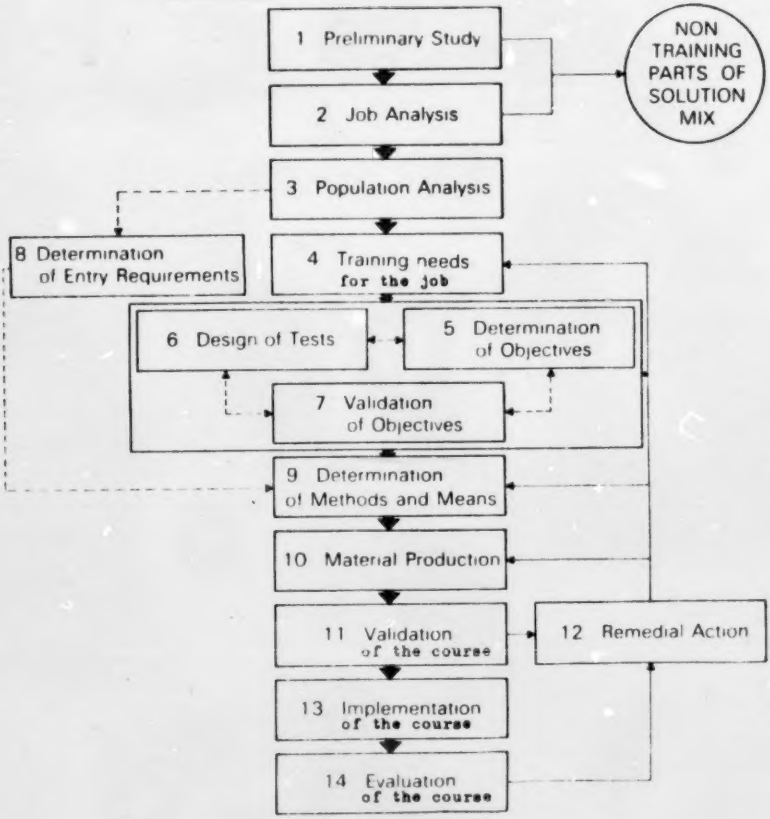

1 Preliminary Study
2 Job Analysis
NON TRAINING PARTS OF SOLUTION MIX
3 Population Analysis
8 Determination of Entry Requirements
4 Training needs for the job
6 Design of Tests
5 Determination of Objectives
7 Validation of Objectives
9 Determination of Methods and Means
10 Material Production
11 Validation of the course
12 Remedial Action
13 Implementation of the course
14 Evaluation of the course

Figure 1 : TRAINING DEVELOPMENT" Model (for every new course)

Table 2 TRAINING MATERIALS PRODUCED DURING THE CODEVTEL PROJECT
Singapore : Operational procedures described in the Satellite System Operation Guide (SSOG) 7 individualized training modules each comprising : - a slide-tape script - a workbook - learning aids (sub-task check list) Total : 500 pages about 350 slides 7 cassettes
Nairobi : First line supervisor, outside plant 5 training modules comprising : - printed documents - case studies - kits etc. - transparencies Total : about 210 pages
Caracas : LM Ericsson ARF crossbar switching equipment 14 job aids (task-orientated instruction = detailed organization chart of tasks, including all the information required to perform them) 21 modules comprising : - slide-tape scripts - workbooks - practical tasks etc. Total : learning aids : about 600 pages training modules (planned) : 800 pages
San Salvador : Planning of rural telecommunication networks 15 job aids (task-orientated instruction) 20 modules comprising : - workbooks (total 200 pages) - slide-tape scripts (total 700 slides, 24 cassettes) - projects (simulated planning of a rural telecommunication network)

Table 2

Rufisque : Maintenance of radio relay equipments (Thomson CSF)

10 training modules each comprising :

- slide-tape script = 20 - 30 slides (15 - 20 minutes)
- 1 programmed text (10 - 30 pages)
- 1 final of intermediate paper-and-pencil test
- instructions for practical work (the performance of station testing operation)

Also 4 modules with similar material except for slide-tape scripts.

Total : about 300 pages
about 350 slides

Yaounde : Power plant maintenance

1 field kit comprising :

- guide (with task-orientated instructions, forms etc.)
- 1 slide-tape script
- 1 workbook

8 to 10 training modules comprising :

- 1 slide-tape script
- 1 programmed text
- practical work

Total : about 250 pages
about 250 slides

Oran : Pentaconta 1000A crossbar local exchanges

76 training modules planned

5 - 6 modules already produced, comprising :

- slide-tape scripts
- trainee documents
- practical work

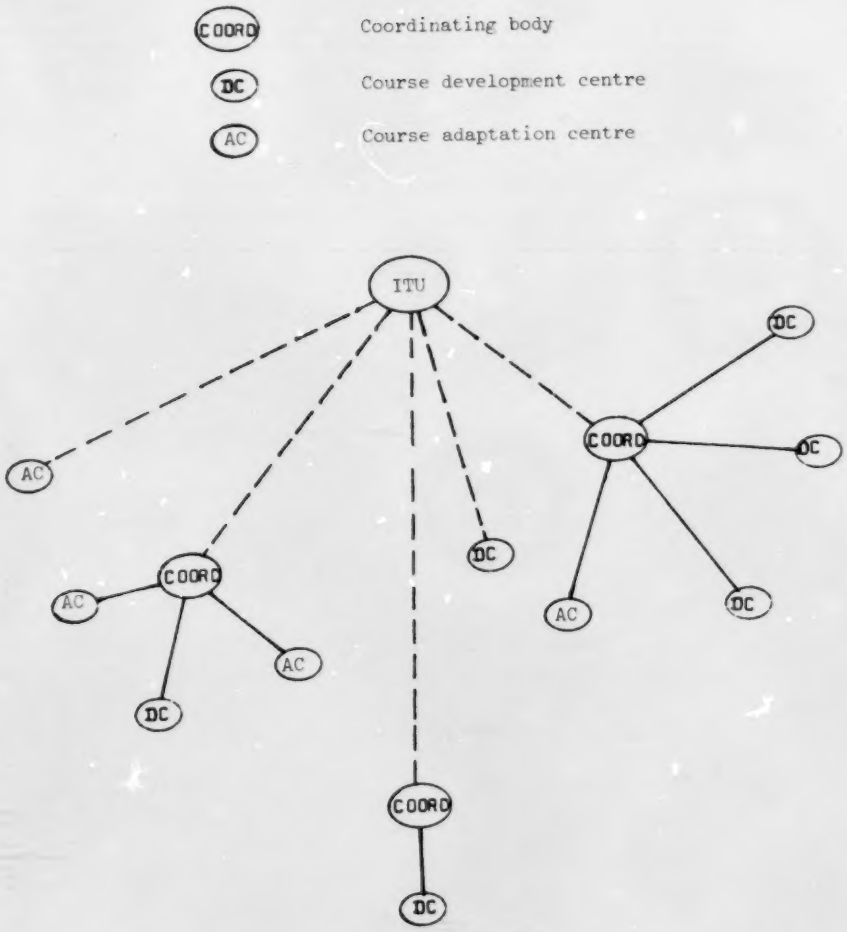


Figure 3 : Examples of possible structures

SLIDE-TAPE SCRIPT: 5.2.4 TEST TONE DEVIATION AND BASEBAND LEVEL

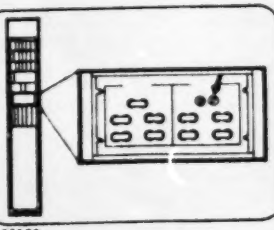
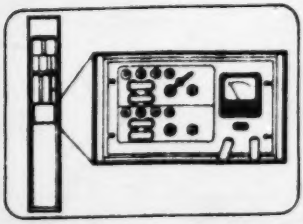
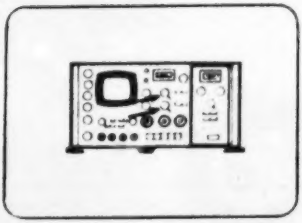
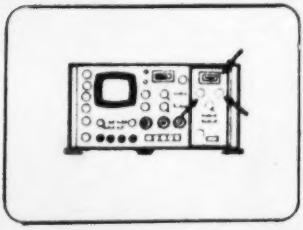
Frame no.	Visual	Audio
12	TO SET THE MODULATOR FOR 10/132 GLOBAL BEAM CARRIER 77570	The objective is to adjust the deviation of the modulator for 1st carrier null using the test tone frequency of 335.62 kHz at the level of +2.5 dBmO. 4 (music)
13	 AT TRANSMIT EARTH STATION 77571	Let us now see what happens at the Transmit Earth Station. 4 (music)
14	 77572	Locate the Tx BDE BAY and disconnect the Baseband Input by removing the appropriate U-link on the Jack Board. 3
15	 77573	Next remove the termination from the IF MONITOR. OUT point which is located on the Operation Board on the FM MODULATOR BAY. We will now proceed with the setting up of the test equipment. 4

Fig. 4 Sample slide-tape script (Satellite Systems, Singapore)

SLIDE-TAPE SCRIPT: 5.2.3 GROUP DELAY RESPONSE

Frame no.	Visual	Audio
24		Then set the Y1 DISPLAY selector switch to the REFERENCE position and the Y2 DISPLAY selector switch to DELAY.
25		Now we will phase lock the Test Receiver by setting the SET LEVEL control fully clockwise and adjust the PHASE LOCK control until the pointer on the PHASE LOCK/LEVEL meter is in the green position of the scale. You may have to set the SET LEVEL control slightly counter clockwise to do this.

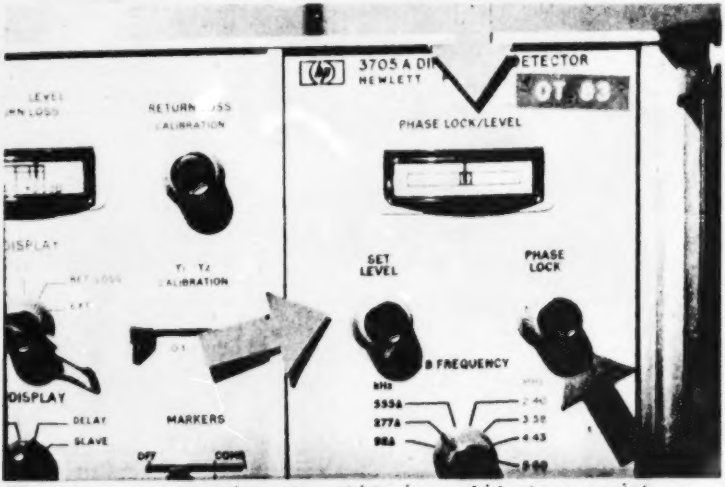


Fig. 5 Reproduction of a slide in a slide-tape script
(slide 25 of above script, Satellite Systems, Singapore)

Fig. 6 Trainee studying an individual model on a slide-tape projector (Satellite Systems, Singapore)

Fig. 7 Discussion of a case study (First Line Supervisors, Nairobi)

TIME	MAIN UNITS/STEPS/AIDS	CONTENT SUMMARY AND REFERENCES
	INTRODUCTION O/H 1 O/H 2	Introduce yourself. Let the trainees present themselves. State module objective and explain briefly the module contents and the timetable.
	Discussion	Explain that in this session, we will be discussing the system of appraisement and the reasons why it is necessary. Promote question : Why do we need an appraisement system? Encourage a free and frank discussion on the appraisement system and allow the group to give their views on how and where the system falls down. Try to gradually steer the discussion to: -Show how well an officer does his job. O/H 3 -Show what weaknesses he has in the performance of his job and what he needs to do to overcome them (if they are remedial) to enhance his future prospects. -Show his special strengths and aptitudes. -If not qualified, to show what development he requires to qualify, how long this might take and what his full potential may be. -To assist: The supervisor to know abilities of his staff for improvement and development his purposes and to enable the supervisor to do his main job of getting the work done in the most effective way. -Management to know how staff are progressing to assit development to plan for the future and to make decisions about promotion, retention after normal retiring age etc.

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Fig. 8 Sample page of an Instructor Guide (First Line Supervisors, Nairobi)
O/H refers to an overhead transparency (see Fig. 9)

OH 2

APPRAISAL AND COUNSELLING

OBJECTIVES

1. TO ASSESS AN INDIVIDUALS PERFORMANCE IN HIS PRESENT JOB, AND TO IDENTIFY HIS STRENGTHS AND WEAKNESSES.

2. TO THINK ABOUT HIS POTENTIAL SYSTEMATICALLY AND HIS CAPACITY FOR A MORE RESPONSIBLE POST

3. TO PLAN HIS TRAINING AND DEVELOPMENT

ALL OF WHICH MEANS: -

TO HELP MANAGERS TO GET THE WORK DONE EFFECTIVELY BY MAKING THE BEST USE OF THE STAFF RESOURCES AVAILABLE TO THEM.

Fig. 9 Sample transparency (First Line Supervisors, Nairobi)

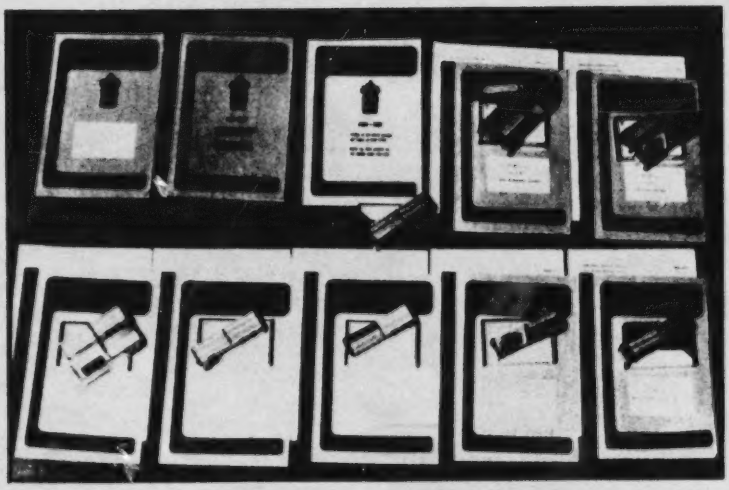

Fig. 10 Training kit for the satellite systems operation course (Singapore) (described in Table 2)

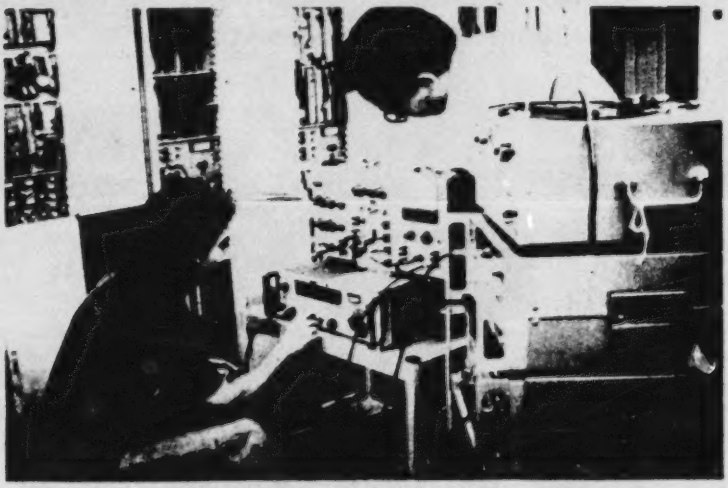

Fig. 11 Practical training on actual equipment (Satellite Systems, Singapore)

ANNEX

THE 14 PHASES OF TRAINING DEVELOPMENT*

(Refer to Figure 1). The 14 phases do not always follow are another in the order indicated - some of them take place simultaneously.

PHASE 1 - Preliminary study

It is assumed that a training need implies that a specific operational problem has been noted or is anticipated.

The purpose of the preliminary study is to examine this problem to see how far it can be solved by training or whether some other solution should be recommended. At the same time an estimate of the cost/benefit ratio of a possible training course is made in order to decide whether such a course should actually be organized.

PHASE 2 - Job analysis

Once it has been decided that training should be given, the tasks involved in the job in question and the way in which they are to be carried out must be analysed in depth. This analysis enables a detailed list to be made of everything the student must be taught if he is to perform the job satisfactorily. The techniques used during this phase include the study of documents, meetings with experts in the job in question, observation and interviews at the work site, etc. At the end of the phase, a document is produced enumerating the tasks forming part of the job and, in particular, all the standards governing those tasks.

PHASE 3 - Student population analysis

A very detailed description is written of the characteristics of the student population affected by the proposed training course. As a rule, this population includes different categories (new staff, retraining, continuous training). Each of these categories must be described in detail.

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* Reprint from the Telecommunication Journal, December 1977, page 573.

Reference is made to all the factors which may affect the training : overall personal characteristics, previous education and training, professional experience, social and economic background, anticipated learning problems, etc. In particular, all the knowledge required to do the job in question should be mentioned.

PHASE 4 - Training needs

Once all the necessary details about the tasks and the trainee population have been ascertained, we can determine the precise purpose of training : what do the students have to learn to perform the job ? In particular, we can decide at this point how far job aids might with advantage replace training components.

A job aid is a document used on the job and which states :

- what has to be done
- how it should be done
- in what order it should be done
- what the job performance standards are.

Examples are : a checklist, a detailed flowchart for fault finding, details of an administrative procedure, and so on (cf. the example in Figure 11). The purposes of job aids are to ensure good work, quality, to simplify job execution, and to reduce training time. So the use of job aids as a complement of or event as a subsitute for training should be considered during phase 4.

PHASE 5 - Training objectives

The "systems" approach implies training by objectives. These objectives describe thoroughly what the student should be capable of doing at the end of the training and act as a sort of guarantee by the training services to the employer that the trainee is operative.

During this phase, what the trainee will be able to do, in what conditions he will be able to do it and what standards he will attain are specified with great precision. The objectives are also arranged in the most appropriate teaching order.

PHASE 6 - Tests

In order to specify clearly the exact significance of the training objectives, this phase is devoted to designing the tests by which the student's progress can be followed and by which it can be established in the most objective possible way whether or not he has attained the training objectives. In the CODEVTEL approach, emphasis is placed on self-applied tests (so that the student himself can check his progress), on "objective" tests (multiple-choice tests, etc.) and on tests in real or simulated situations.

PHASE 7 - Validation of objectives and tests

Throughout the course development process, and effort is made to evaluate products in order to guarantee their quality. In this phase, the validity of the objectives and tests are checked against the job descriptions; that is to say, it is ascertained that someone who does the job competently will meet the training objectives and be able to pass all the tests and, conversely, that the tests give an accurate estimate of how far a given trainee is competent for the job.

This validation is carried out by means of systematic tests on sample populations of students and competent staff members.

PHASE 8 - Entry levels

Once the training objectives have been classified in the most appropriate teaching order and once the training modules have been designed, it is then possible to determine the prerequisites necessary for tackling each of the modules. In other words, we must define exactly what each student must be capable of doing before he can start on a given module. Admission levels are defined in terms of observable and measurable performance so that valid admission tests can be formulated.

The admission tests should enable every trainee to be assigned to the training most suited to his level.

PHASE 9 - Determination of methods and means

Having closely analysed the training objectives and the student population, in this phase one can determine the most suitable teaching methods according to the nature of the subject, the purpose to be achieved, the students to be trained and external circumstances. The CODEVTEL method seeks to extend the range of teaching methods, which often are ill suited both to the objectives and to the students, by incorporating more modern methods comprising self-instructions, audio-visual media and training in simulated situations which are designed to facilitate learning and to arouse the interest of the student while orienting him towards his future job. It should, however, be pointed out that the use of audio-visual methods is not the main feature of the CODEVTEL approach. Methods are chosen in the light of training needs and external constraints and may well, at least in part, include traditional methods.

Two main steps have to be taken when selecting training methods. First the general training technique is selected : lecture, group discussion, laboratory exercises, programmed learning, etc. The selection is made on the basis of "demand factors" pertaining to the training objectives and in particular to the type of capability aimed at. The selection also should take into account the "constraints" imposed by the environment (is the required material available ?), by the trainers (are they able to apply a particular training technique ?) and by the trainees (how will they react to a particular training technique ?). Other factors may also influence the choice, such as the size of the group (more or less individualized training), the importance of group interaction (create team spirit), and the degree of autonomy left to the trainers and/or the trainees.

Second, the most appropriate media are selected on the basis of the training content and taking into account external constraints. Examples are : printed documents, transparencies, slides, sound tapes, models, real equipment, and so on. Obviously, there will be some interaction between the training techniques and the media selected.

Finally, a detailed scenario of the training process is designed for each training module, describing as completely as possible the exchange of information between the trainer (of the training material, as the case may be) and the trainee.

A great variety of training methods are used in the CODEVTEL training modules. Page 3 gives a number of examples.

PHASE 10 - Production of teaching materials

Teaching materials are produced in accordance with the output document prepared in phase 9. As they are produced, the content is checked by a specialist in the job in question and its instructional value is verified by partial tests. All teaching materials are accompanied by a teacher's guide with precise instructions for their use.

Phase 10 results in the production of complete training "packages", which usually contain trainee documents (sometimes programmed texts), type slide programmes (slides with a recorded commentary), mock-ups, instructions on practical work, tests (with model answers and a guide for making corrections) and an instructor's guide for the whole set of training materials.

PHASES 11 and 12 - Validation and remedial action

When prepared, the teaching materials are validated, i.e., tested on a representative sample of the student population. The necessary changes are made (phase 12) and, if necessary, the documents produced when designing the material are revised or corrected. In this case, a second validation may be necessary. A validation report assesses the efficiency of the materials produced and indicates, in particular, the extent to which the trainees attain the training objectives formulated in phase 5.

PHASE 13 - Implementation

When all the materials have been validated, they can be introduced in the training centres. It may be necessary to train the instructors in their use. In the case of international exchanges, the materials will have to be translated and/or adapted to local conditions. The job analyses will be very useful for this purpose because they will provide a check on how far the tasks described correspond to local requirements and to what extent changes are necessary.

Once these changes have been made, the materials are validated in the centres in which they are to be used and are then incorporated in the programmes.

PHASE 14 - Evaluation

An evaluation report is prepared after the application of every set of teaching materials produced. The purpose of the report is to describe the results of the development process and to confirm, in particular, how far these results correspond to the expectations formulated in phase 1.

The evaluation report will also contain a final estimate of the cost/benefit ratio and will make recommendations with a view to improving the development process in subsequent similar projects.

The set of 14 phases described above constitutes the "CODEVTEL process" which can be applied to any training design project. Specifically, it is in line with this process that the seven design teams have worked in the course of the project.